

# RADIO.EDU

## Low Power Ain't No Power Leaky Cable AM and FM

by John Devecka

*Continuing his discussion of how to get a signal "out there," John tackles some of the other options for low power stations.*

[BALTIMORE, Maryland - December 2003] Among the options for low power operation are radiating (or "leaky") cables. These systems are designed to spread signal in a fairly even pattern along their full length, unlike a typical vertical antenna system. They can be likened to a garden sprinkler hose, with holes punched evenly along their length; the signal from these cables then will leak in a roughly cylindrical pattern from end to end, giving you some unique benefits.

For example, unlike the fixed vertical antenna, radiating cables are a coaxial (or tri-axial in some cases) cable that is flexible enough to be shaped to meet the needs of the receiving audience. Whether it is alongside a road, around a balcony or inside a building ceiling, radiating cable offers the kind of flexibility needed for many applications. Areas of interest get coverage; power is not wasted where it is not needed.

Radiating Cable systems fall under three sections of the FCC rules: §15.211 (Tunnel Systems); §15.221 (AM); §15.239 (FM) and §90.242 (Traffic Information Systems – Licensed Only). We will talk about the first three here to give you a good basic primer on them. I will cover TIS systems in another column since it has its own complications.

### OUTDOOR AM SYSTEMS

Some of the most common applications for Radiating Cables are outdoor and tunnel systems. This is true on a lot of different frequencies, but the first documented and successful application of Radiating Cable outside was for the 1939 World's Fair when Bill Halstead ran his cable across the George Washington Bridge to communicate with attendees.

Tunnel systems have their own set of rules within Part 15 (§15.211) which allows them to essentially run at any power level provided that outside the tunnel they still comply with §15.209 emissions limits and §15.207 limits on the power lines. A typical tunnel system consists of radiating cable running the length of the tunnel (usually on the ceiling) and fed with a linear amplifier or transmitter. In those cases where the system is rebroadcasting a licensed station (for example: WJR in the Detroit-Windsor Tunnel) the transmitter is usually a Type-Accepted unit that ensures synchronous operation via lines from the station.

A more common outdoor installation is Radiating Cable on a roadside. These are the systems that greet visitors to Walt Disney World and EPCOT Center, and tell you about the animals as you drive the safari at Six Flags Great Adventure. They are installed in the ground alongside a roadway, ideally in a protective conduit, and buried to prevent



**Radiating cable being installed roadside at Six Flags.**

their easy access by critters (squirrels seem to find the jacketing very tasty). The nice part about radiating cable on a roadside is the ease of configuration to the bends in the road, so following routes for a consistent distance is easy, giving a better coverage result.

### INDOOR COVERAGE

The most common indoor installation of Radiating Cable is along balcony facings and stadium overhangs to provide coverage into the seating areas of arenas. These would fall under the §15.221(a) limitations for radiated field, or under the campus antenna limitations if you wish – if you are doing this in your own school stadium.

Probably the greatest success for Radiating Cable systems was the Amsterdam 2000 Conference hosted by Billy Graham. A total of 28 languages were run simultaneously on individual Radiating Cable systems, each driven by transmitters running approximately eight watts in the RAI Center in Amsterdam. Despite many naysayers, who felt it was not possible to provide good audio to such a large area in this manner, the systems performed with great success for nearly 11,000 people from 209 nations over 10 days.

For temporary events, such as Christmas Light Shows, Radiating Cables can be laid on the ground alongside a road, connected to transmitters and run for the duration of the event. At the end, roll up the cable, and stash it away until next year! All in all, it provides simple, legal and effective coverage.

Radiating Cable AM systems, typically, run in the neighborhood of \$12,000 for a mile of cable and related equipment. This can vary depending on installation requirements, but it gets you in the right general area for budgeting. Installation is pretty easy and the cables are typically very flexible.



**Roadside radiating cable transmitter cabinet at Six Flags.**

### OK, ENOUGH AM ALREADY!

There is one option out there for FM, and a couple of ways to do it. §15.239 allows you to run an FM system with a field strength of 250uV/m at a distance of three meters. That is about all it says. There are specific references in other areas of Part 15 to kits, antenna mountings, etc., but the important thing about §15.239 is that it lets you choose your antenna and transmitter. No, I do not mean home brewing it, I mean you can use a certified system with radiating cable or a fixed antenna depending on your plans.

We need to start by clearing up the #1 misunderstanding for FM and low power. *There is no 100 milliwatt rule for FM.* None. Really! So pay attention when you see devices that "meet the FCC rules" and have 100mW of power. Typical fixed antenna systems for unlicensed FM systems do not exceed 18 milliwatts to meet the field limits!

A fixed antenna system is typically about the size of an NAB engineering handbook, but much lighter (OK, it is on the shelf next to me, and I figured most of you know how stupidly heavy it is). You likely have seen these devices for sale in many places – an FM transmitter for your iPod, or to connect your CD player to the car radio without wires, or to jump from your computer

to the home stereo, etc., and you understand their range limitations. Typically, these devices are designed for some portion of the FM band, occasionally all of it, and they reach 50 to 100 feet at best. They are subject to the kind of interference you would expect when you see their power level.

### FM FOR THE WHOLE BUILDING

There is another option, however, one that actually works to cover a whole building, or more. Yes, we are talking about Mr. Radiating "Leaky" Cable. He has never been fond of being called "Leaky" since it sounds like an accident, so stop it.



**Amsterdam 2000 Transmission Room**

Radiating Cable systems are subject to the same field limits as the fixed antenna, but they can have a virtually unlimited length of antenna. That changes the installation considerably, but it also means you can make the rule work for you. Instead of a small sphere of coverage, you have a cylindrical option, which can be as long as a building! By installing a radiating cable system inside a building, and running the full length, you can ensure coverage inside it and low signal outside.

Discussions long ago with the FCC yielded the acceptance that field measurements with a FIM-71 inside a dorm hallway was next to impossible (try it some time), so they have accepted measurements for §15.239 to be made three meters outside the building. The logic is that the target audience is inside the building and the structure will attenuate signal enough to meet the rules where they can be practically measured.

The plus side? You can take a typical dorm building that is 200 feet long and 3 stories, run a single radiating cable down the ceiling of the middle floor and you will generally get FM Stereo coverage of the whole building within §15.239 limits. Pretty easy, but unfortunately not real cheap. It is FM after all, and do not all of your rate cards say FM costs more? That is the down side. The cost can be about two to three times that of AM systems, and getting the right design is critical to success. But hey, you do get two channels!

A typical FM radiating cable system runs about \$2000-3000 per building, depending on more factors than we have column inches here. There are options for distributing the signal, installing the cable, and more, all of which can influence the design and costs. It is not a system design for the meek, but the resulting FM Stereo signal is worth the effort and costs.

### USE YOUR VISION

Low power systems are amazingly flexible, and effective, but they do require experience to design and patience to fine tune to your needs. When you are done, however, you do not have to deal with Public Files, license fees, speech controls, commercial issues, etc., and you can run whatever programming you want.

I have designed systems for applications from drive-thru lines to evangelical churches, to sports to health clubs. If you find a place you wish you had a signal (original or rebroadcast) just crack open Part 15 because the solution is already there.

*John Devecka is Operations Manager for WLOY in Baltimore and spent a past life designing, supplying and installing Low Power Broadcasting systems on a global scale. He is believed to sleep with a copy of Part 15 under his pillow. He can be reached by email [wloy@loyola.edu](mailto:wloy@loyola.edu) or phone at 410-617-5349.*